

**IAP20 Rec'd PCT/PTO 27 JAN 2006****PROCESS FOR KNITTING AN ARTICLE OF LADIES' UNDERWEAR IN ONE PIECE****CROSS REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application claims the benefit under 35 U.S.C. §365 of International Application No. PCT/FR04/02636, filed on October 15, 2004 and claims the benefit under 35 U.S.C. §119 of French Application No. 0312285, filed on October 21, 2003, the entire contents of both of which are incorporated by reference herein.

**BACKGROUND OF THE INVENTION****1. Field of the Invention**

**[0002]** The present invention relates to a process for knitting an article of ladies' underwear in one piece of tubular knitwear and to an article obtained according to the process.

**2. Description of Related Art**

**[0003]** Known knitting processes allow cylindrically symmetrical articles to be made in one piece. Such processes are implemented on circular knitting machines in which the needles are arranged in a ring, the feed yarn being orientated perpendicular to the longitudinal direction of the knit and of the needles.

**[0004]** By using these processes, it is easy to make the trunk part of textile articles, which is substantially cylindrical.

**[0005]** On the other hand, articles of ladies' underwear of the bra type which are relatively asymmetrical, compared with a tubular article, can only be partially made on a circular knitting machine, since the article is subsequently completed by having other components added to it.

**[0006]** Some articles of ladies' knitwear of the cropped top or "body" type are relatively easy to make in one piece from tubular knitwear without other components having to be added to them.

**[0007]** Reference may be made particularly to the document FR 2 783 532, in which an article of ladies' underwear is described that has two coaxial layers separated by a fold-over part or basque and knitted in one piece; the inner layer having parts knitted more tightly to form reinforcements adapted to adjust particularly to the level of the chest.

**[0008]** However, the process implemented to make this article of ladies' underwear does not, for example, allow a bra to be made with stays, which can only be obtained by means of a stiff added component which is for example fed into a gusset edging the cups of the bra.

## SUMMARY OF THE INVENTION

**[0009]** One purpose of the present invention is therefore to make an article of ladies' underwear in a single piece that has a single layer, to which it is not necessary to add stiff components to form stays.

**[0010]** To this end, a first objective of the present invention is to propose a process for knitting an article of ladies' underwear in one piece of tubular knitwear, the article being knitted with a basque which extends along edging the lower part of the cups of the article, and the basque being knitted by holding a plurality of contiguous stitches substantially aligned relative to the direction of the weft, in the areas located facing the cups of the article so as to form, by releasing the contiguous stitches, at least one bead approximately parallel to the basque in the areas, so as to create stays.

**[0011]** One characteristic of the invention, therefore, lies in the method of knitting the areas of the basque located at the base of the cups which allows beads to be made

that form stays. In that way, there is no need to add stiff components to form the stays, which means that the article of ladies' underwear can be made in one ready-to-wear piece. By using this process, the articles are able to be produced at an advantageous cost.

**[0012]** According to one particularly advantageous method of implementing the invention, the quantity of stitches held in the direction of the weft is gradually made to vary on either side of a central portion of the areas and the held stitches are released so as to form a bead with its cross-section varying as it moves away from the central portion.

**[0013]** In that way, stays are formed with the areas corresponding to the cups having a bulkier and stiffer central portion which diminishes the further it extends on either side. In this way as will be explained in more detail in the remainder of the description, on the one hand as it moves away from the central portion, the basque area is pressed flat forming a first flexible part which extends and which is intended to be supported against the lateral part of the body trunk and on the other hand, a second part adapted to join the basque area located facing the other cup.

**[0014]** According to a particular embodiment of the invention in accordance with the previous method of implementation, firstly a first part is knitted in which, from a first quantity of held stitches of a first row, the held stitches are gradually released starting from the two ends of the first quantity, towards the central portion, up to a second row in which a second quantity of stitches less than the first quantity is held, and from which the second quantity of held stitches is released; and, a second part is then knitted in which, from a third quantity of held stitches of a third row, stitches are gradually fastened, on either side of the third quantity, diverging relative to the central portion, up to a fourth row in which a fourth quantity of stitches greater than the third quantity is held and from which the fourth quantity of stitches is released.

**[0015]** Thus, by using this particular embodiment, two consecutive beads are made, which to advantage, are symmetrical to each other, which allows an even bulkier and stiffer stay to be made with a substantially circular cross-section as will be described in more detail in the remainder of the description.

**[0016]** In order to coil the bead or beads to form the stay, in a particularly advantageous way, fastening stitches are held before holding the plurality of contiguous stitches and the fastening stitches are released after releasing the plurality of contiguous stitches. In that way, the free edge of the basque, which corresponds, substantially to the start of the knitting is held on the needles by the fastening stitches, while the basque and the areas are knitted. After the beads have been made, the fastening stitches are released so as to coil the beads into a single component thus forming the stay.

**[0017]** Preferentially, the basque is knitted with at least one additional yarn in the areas to stiffen them. Thus, in addition to the contour, which is given to the basque in the areas, the additional yarns, which are preferably chosen to be stiffer, allow even stiffer stays to be formed.

**[0018]** A second object of the invention is to propose an article of ladies' underwear knitted in one piece of tubular knitwear, the article being knitted with a basque which extends along edging the lower part of the cups of the articles, and the basque being knitted by holding a plurality of contiguous stitches substantially aligned relative to the direction of the weft, in the areas located facing the cups of the article so as to form, by releasing the contiguous stitches, at least one bead approximately parallel to the basque in the areas, so as to create stays.

**[0019]** Other particularities and advantages of the invention will emerge from reading the description given hereinafter of particular embodiments of the invention, given by way of example and non-restrictively.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0020]** Figure 1 is a diagrammatic front view of an article of ladies' underwear obtained by the process in accordance with the invention;

**[0021]** Figure 2 is a partial diagrammatic detail view of the article shown in Figure 1, during its development; and

**[0022]** Figure 3 is a partial diagrammatic perspective view of a cross-section along III-III of the article shown in Figure 1.

## DETAILED DESCRIPTION OF THE INVENTION

**[0023]** Figure 1 shows a bra 10 obtained in one piece by a process in accordance with the invention and by using a circular knitting machine of the "Santoni" brand "SM8" type. This type of knitting machine is well known and it already allows the manufacture of "upper body" articles of the "body", "top" or cropped top type without stays.

**[0024]** The bra 10 has a front part 11 and two lateral parts 12, 13, each terminated by a free end 14, 15. The two free ends 14, 15 are fitted with fastening means so as to be connected together at the back in such a way as to keep the front part 11 laterally on the chest. The front part 11 comprises two cups 16, 18 extended by straps 20, 22 connecting the lateral parts 12, 13 so as to keep the cups 16, 18 vertical.

**[0025]** Initially, before the bra 10 is made, the two free ends were connected together and the article formed a piece of tubular knitwear. It has been cut in accordance with a known method of implementation to make the bra 10.

**[0026]** On the other hand, it has in its lower part a fold-over part, or basque 24, which is knitted according to a process in accordance with the invention and which allows stays 26 to be made located in the areas of the basque 24 edging the cups 16, 18.

**[0027]** The basque 24, as shown in figure 1, is formed of a double layer, which is shown opened out in figure 2 in correspondence.

**[0028]** In figure 2 the knitwear part of the basque 24 corresponding to the areas has been shown, the lower part 28 corresponds to the start of the knitting and the upper part 30 corresponds to the end of the knitting of the basque 24.

**[0029]** The process of knitting in accordance with the invention will be described with reference to Figure 2 and to Figure 3 in which the lower part 28 of the basque 24 corresponds to the first row of stitches 32 and the upper part 30 of the basque 24 corresponds to an intermediate row of stitches 34.

**[0030]** The process begins by knitting on the circular machine described above, from the initial row of stitches 32, a first length of the basque 24 corresponding to a few rows of stitching, then stitches are held evenly spaced apart from each other over the whole circumference of the basque which will only be released after the basque 24 has been fully knitted in such a way, as will be explained in the remainder of the description, as to fold the knitwear over itself. A held stitch 36 allowing this folding is shown in figure 3.

**[0031]** Then a second length is knitted up to a first row of stitches 38 shown in Figure 3 and in Figure 2, and from which a first quantity of contiguous stitches is held, evenly spaced apart from each other, over a width L1 corresponding to the areas intended to edge the lower part of the cups 16, 18.

**[0032]** Knitting is continued over a third length L3 during which, from the first row of stitches 38, the contiguous stitches held from the first ends 42, 44 of the first quantity of contiguous stitches are gradually released, for each of the areas; and this is done symmetrically relative to a central portion 46, up to a second row of stitches 47 identified in Figures 2 and 3. The effect of releasing the stitches is to intersect two knitwear portions.

**[0033]** After knitting the third length L3, a second quantity of held stitches less than the first corresponds to a width I2, centred relative to L1, for each of the areas. From this third length L3, the second quantity of stitches held from the first row 38 is released, so as to intersect the first row of stitching 38 over the width L1 with the second row of stitching 47 and to form a first bead 48 consisting of two folds 50, 51. This bead has a relatively constant cross-section over a width I2 and it is prolonged substantially conical on either side up to the width L1.

**[0034]** After that, after knitting at least one row of stitches, a second quantity of contiguous stitches of a third row of stitching 52 is again held in the areas, spaced apart from one another, over a width I2 and facing the second quantity of stitches released from the first row of stitches 38.

**[0035]** Then, knitting is continued symmetrically over a fourth length L4 during which, from the third row of stitches 52, stitches are gradually fastened from the two ends 54, 56 of the second quantity of contiguous stitches, for each of the areas. As in respect of knitting the length L3, the stitches are gradually fastened symmetrically relative to the central portion 46, as far as a fourth row of stitches 58 identified in Figures 2 and 3.

**[0036]** Additionally, the length of knit L4 is substantially equal to L3, with the result that the quantity of held stitches in the fourth row of stitches 58 corresponds substantially to the first quantity of stitches and to the width L1.

**[0037]** In a symmetrical way, the second quantity of held stitches of the third row 52 and all the other stitches held up to the fourth row 58 during the knitting of the length L4 are then released, in such a way as to intersect them with the stitches of the fourth row 58 over a width corresponding substantially to the width L1.

**[0038]** A second bead fully symmetrical with the first in the direction of the weft and having two folds 60, 62 is thus formed.

**[0039]** Next a fifth length L5 shown in figure 3 is knitted, then the held stitches, matching the stitch 36 shown in Figure 3 and which are evenly spaced apart over the whole circumference of the basque 24, are released.

**[0040]** In that way, on the one hand stays 26 are formed in the areas of the basque 24 intended to edge the cups 16, 18 where the beads have been made and which is shown in cross-section in Figure 3, and on the other hand, two folds are formed applied one against the other in the lateral parts of the basque 24.

**[0041]** After the basque 24, knitting is continued to make, in a conventional way, the cups 16, 18 and the other components of the bra.

**[0042]** In a particularly advantageous way, polyamide yarns and polyamide covered elastane yarns are used to make the bra according to the invention.

**[0043]** Additionally, according to one particularly advantageous method of implementation, an additional yarn is added, made of PVC for example, in the areas corresponding to the stays when the basque is knitted. In that way the stays so formed are even stiffer.

**[0044]** Furthermore, the basque portion located between the areas of the basque 24 forming stays 26 is able to be knitted with a particular stitch type, different from that which is used for the other basque portions.

**[0045]** The same thing is true for the other parts of the piece of tubular knitwear in which, in a known way, it is wished to obtain particular aesthetic or mechanical effects.